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(U*) Non-perturbative Extraction of Tripartite Vacuum Entanglement

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Entanglement harvesting –the process of entangling qubits by extracting vacuum entanglement from a quantum field –provides information about the structure of the quantum vacuum. While there has been much work done on harvesting bipartite entanglement, the multipartite structure of the vacuum has received virtually no attention. Here I report on the first results of an investigation of non-perturbative harvesting of tripartite entanglement. I consider a set of three 2-level Unruh-DeWitt detectors (qubits), each strongly interacting with a scalar field in (3+1)-dimensional Minkowski space-time for a short interval (modelled with Dirac delta-functions), and compute the reduced density matrix for this system after interaction. Placing the detectors in both triangular and linear configurations, the resulting entanglement is computed from the π-tangle for each. We find, for any configuration, that a substantial amount of entanglement can be harvested if each detector interacts just once. This stands in strong contrast to the bipartite case, where it is necessary for at least one detector to interact more than once. I discuss the implications of these results for how information is sent and received via quantum fields.

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